SPECIFICATION

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RECYCLABLE, RUBBER-LIKE THERMOPLASTIC BACKING MATERIAL USED IN A THROW-IN MAT FOR A VEHICLE FLOOR

Background of Invention

Technical Field

[0001] The present invention relates generally to floor mats for vehicles and the like, and more particularly to a recyclable, rubber-like thermoplastic backing material used in a throw-in mat for a vehicle floor.

Background

[0002] Throw-in mats are often provided in vehicles for protecting carpeted vehicle floors. These mats typically include nibs formed on the back of the mat to grip the carpeted floor. The nibs extend from a backing layer that is secured to a primary backing layer and the carpet pile, and a carpet pile is tufted (sewn) into the primary backing layer.

[0003] As shown in Figure 1, a typical throw in mat 10 according to the prior art 10 includes a primary backing layer 12 having first and second sides 14,16 thereof. A carpet pile 18 is tufted, or sewn, into the first side 14 of the primary backing layer 12. The primary backing layer 12 is preferably a woven polypropylene or non-woven polyester material.

[0004] Coupled to the back side of the primary backing layer 12 is a latex backing layer 13 and a rubber backing material 15. The latex backing layer 13 is necessary to adhere the tufted carpet pile 18 to the primary backing layer 12.

[0005] Alternatively, the primary backing layer 12 and the rubber backing material 15 (without the latex backing layer 13) could also be made of a thermoplastic material, which has a cost savings over rubber materials. However, typical thermoplastic backing materials that are used in throw-in mats lack the feel of rubber mats that is highly desirable among consumers. This is due primarily to the desire to produce throw-in mats that are light and inexpensive.

[0006] Another problem with currently available throw-in mats is that the thermoplastic backing material is not recyclable. This leads to increase cost in manufacturing the throw-in mats associated with waste removal.

[0007] It is therefore an object of the present invention to provide a thermoplastic backing material for use in throw-in mats that has the feel of rubber. Further, it is highly desirable if this thermoplastic material is also recyclable.

Summary of Invention

[0008] In accordance with the above objects, a new thermoplastic backing for a throw in mat is proposed. The thermoplastic backing has the feel and weight of a rubber backing. Further, the backing is recyclable, thereby reducing costs associated with waste disposal.

[0009] In addition, as compared with rubber backed throw-in mats, the new thermoplastic material does not require a latex backing to adhere the rubber-like backing material to the tufted carpet pile and primary backing layer. This may lead to decreased manufacturing costs associated with purchasing and applying the latex backing material.

[0010] Other objects and advantages of the present invention will become apparent upon considering the following detailed description and appended claims, and upon reference to the accompanying drawings.

Brief Description of Drawings

[0011] Figure 1 illustrates a section view of a throw-in mat according to the prior art;

[0012] Figure 2 illustrates a section view of a throw-in mat according to a preferred

embodiment of the present invention;

[0013] Figure 3 illustrates a process for making the thermoplastic backing material used in Figure 2; and

[0014] Figures 4 and 5 illustrates the process for adding the thermoplastic material made in Figure 2 to the primary backing material and carpet pile to form the throw-in mat of Figure 2.

Detailed Description

[0015] Referring now to Figure 2, a throw-in mat 10 is shown in accordance with the present invention. As shown, the throw-in mat 10 includes a primary backing layer 12 having first and second sides 14,16 thereof. A carpet pile 18 is tufted, or sewn, into the first side 14 of the primary hacking layer 12. The primary backing layer 12 is preferably a woven polypropylene or non-woven polyester material.

[0016] The carpet pile 18 may be of many constructions well known to those of skill in the art. Two carpet constructions commonly used include Shiva and Paramount.

[0017] A recyclable thermoplastic backing material 20 is secured to the second side 16 of the primary backing layer 12. The recyclable thermoplastic backing material 20 is preferably a recyclable thermoplastic material having the look and feel of a rubber backing. One preferred composition of the recyclable thermoplastic backing material 20 is shown below in Table 1. The recyclable thermoplastic backing material 20 is preferably extruded onto the primary backing layer 12. This is shown below in Figure 4. The recyclable thermoplastic backing material 20 is then heated under pressure to form a desired pattern on the bottom of the recyclable thermoplastic backing material 20. This pattern can include a number of nibs 26 and grooves 22 to help secure the mat 10 to a carpeted vehicle floor.

[0018] The composition of the backing material 20 is preferably based on an ethylene-octene copolymer formed using a metallocene catalyst and other processing aids. The ethylene-octene copolymer is then further processed to form the backing material 20 that is thermoplastic and recyclable. The backing material 20 provides a rubber feeling and weighted material without the additional costs associated with a rubber

backing material, costs that include manufacturing costs and recycling costs.

[0019] Metallocene is the general name for a family of catalysts that have been used in forming ultra low-density polyethylene (ULDPE) polymers. Two preferred metallocene catalyst materials are Exact, manufactured by Exxon, and Engage, manufactured by Pont Dow Elastomers.

[0020]

Table 1 below shows one preferred composition for the recyclable thermoplastic backing material 20 of Figure 1.

TABLE 1

INGREDIENT	DESCRIPTION	WEIGHT
Ethylene-octene copolymer formed using metallocene catalyst	Thermoplastic copolymer (.885 density and 30 melt index)	25
Ethylene-octene copolymer formed using metallocene catalyst	Thermoplastic copolymer (.885 density and 3 melt index)	13.335
Paraffinic Oil	Plasticizer	3.75
Zinc Oxide	Additive	.4275
Heat Stabilizer	Additive	.30
Processing Aid	Additive	.15
Low Density Polyethylene	Thermoplastic Additive	1.5375
Calcium Carbonate ($CaCO_3$)	Filler	55.5

[0021] While the ingredients as listed in Table 1 are shown in a particular order from top to bottom, it is likely that the order of addition of ingredients will not materially affect the composition of the backing material 20 to be formed as described below in Figure

3.

[0022] Of course, one of ordinary skill in the art appreciates that the composition of the backing material 20 is merely representative of a potentially limitless variations in the material compositions based on ethylene-octene copolymers formed using metallocene catalyst and is not intended to be limiting. Further, other thermoplastic copolymers other than ethylene-octene, or other thermoplastic polymer or copolymer materials blended with the ethylene-octene copolymer, are specifically contemplated by the present invention as long as they meet the requirements of being recyclable and providing a rubber feeling and weighted backing material.

[0023] Figure 3 shows the process for forming the recyclable thermoplastic backing material 20. The major ingredients for forming the recyclable thermoplastic backing material 20 as described in Table 1 above are first loaded into one or more loss in weight feeders 50. Again, as described above, it is preferable that the ethylene-octene copolymer having the 30-melt index is added to the feeder 50 prior to introduction of the other major ingredients. The feeders 50 feed the raw materials into a continuous mixer 52, which mixes the raw materials. The mixer 52 is coupled to an extruder 54, which mixes, melts, and extrudes the raw materials in a method well known in the art. The extruded raw materials are then pelletized using an underwater pelletizer 56, which is fed water from a tank (not shown) through a water pump 60, therein forming pellets 61. The pellets 61 are then introduced to a spin dryer 62. The spun dry pellets 61 fall into a fluidized bed/dryer 64 to further dry the pellets. The pellets 61 then enter a cooler/classifier 66 that cools the pellets 61 and separates the pellets 61 by size. The sized pellets 61 are then sent to a silo 68 for storage. The silo is maintained below about 25 degrees Celsius (about 80 degrees Fahrenheit) to prevent the pellets 61 from sticking together. The sized pellets 61 are then available to form the throw-in mat as described below in Figure 3.

[0024] Referring now to Figure 4, the sized pellets 61 are introduced, or fed, to an extruder 70 for melting. The melted pellets 61 then enter a die 72, which forces the material out at the bottom 74 at a desired thickness. Preferably, the temperature of the melted pellets 61 is approximately 165 to 185 degrees Celsius, and more preferably about 175 degrees Celsius (350 degrees Fahrenheit), as it exits the bottom

74 of the die 72. A feed roll 76 containing the primary backing layer 12 coupled to the carpet pile 18 is unrolled and closely coupled to the die 72. The melted pellet 61 material is pressed to the second side 16 of the primary backing layer 12 between a pressure roll 80 and a chill roll 82 and rolled onto a roller 84. The rolls 80, 82 apply sufficient pressure to adhere the recyclable thermoplastic backing material 20 to the primary backing layer 12.

[0025] As shown in Figure 5, the rolled material 87 is then cut to an appropriate size and placed in a mat press 88. The rolled material 87 then molded under heat and pressure for a sufficient period of time to allow the thermoplastic backing material 20 to flow to form the desired shape. As one of ordinary skill in the art recognizes, the amount of heat, pressure and time may be varied depending upon the composition of the thermoplastic backing material and the desired surface quality. Normal pressings of 20-25 tons at approximately 155 and 175 degrees Celsius, and more preferably at about 165 degrees Celsius (approximately 330 degrees Fahrenheit), for about 20 seconds are used to flow the thermoplastic backing material having a composition as shown in Table 1.

[0026] By modifying the mold itself, the pressing process can also form the nibs 26 and grooves 22 on the bottom surface of the recyclable thermoplastic backing material 20.

[0027] When the cycle is complete, the rolled material 87 is removed and placed into a cold press 94, where pressure is applied to cool the material, therein forming the throw in mat 10. The mat 10 is removed from the cold press 94 and may be subsequently trimmed to a desired shape.

[0028]

Table 2 below illustrates the various performance characteristics of throw in mats 10 made with made with Shiva and Paramount carpet pile 18 material in accordance with the present invention.

TABLE 2

TEST	CLASSIFICATION CRITERIA	SPECIFICATION LIMITS	PARAMOUNT WITH 52 OZ. THERMOPLASTIC BACKING MATERIAL	SHIVA WITH 52 OZ. THERMOPLASTIC BACKING MATERIAL
Shrink Water MD	%	+/-2	0.00	0 00
Shrink Water AMD	%	+/-2	0.00	0.00
Shrink Heat MD	%	+/-2	0.40	0.75
Shrink Heat AMD	%	+/-2	0.00	0.00
Dim Stab Exp/Cont MD	%	+/-2	0.40	0.40
Dim Stab Exp/Cont AMD	%	+/-2	0.20	0.25
Tensile Str MD	Newtons	400 MIN	869.40	888.60
Tensile Str AMD	Newtons	400 MIN	766.38	792.88
Tensile Str Imrsd MD	Newtons	400 MIN	926.80	913.80
Tensile Str Imrsd AMD	Newtons	400 MIN	769 38	736.88
Tensile aft 112.8 kJ % Of Orig MD	% Change	80%	100.64	93.18
Tensile aft 112.8kJ % Of Orig AMD	% Change	80%	92.02	89.91
Tensile aft 112.8kJ MD	Newtons	RESULTS	857 00	828.00
Tensile aft 112.8kJ AMD	Newtons	RESULTS	705.25	712.88
Trap Tear MD	Newtons	90	255.80	270.40
Trap Tear AMD	Newtons	50	201.00	197.60
Trap Tear Imrsd MD	Newtons	90	272.80	282.20
Trap Tear Imrsd AMD	Newtons	50	215.60	203.00

Tuft Bind Orig	Newton	16	20.79	20 31
Tuft Bind H/A	Newton	10	21.80	15.49
Adh Cpt/Mat Orig MD	N/mm	+/- 0.96	Can't Separate	Can't Separate
Adh Cpt/Mat Orig AMD	N/mm	+/- 0.96	Can't Separate	Can't Separate
Adh Cpt/Mat Imrsd MD	N/mm	+/- 0.96	Can't Separate	Can't Separate
Adh Cpt/Mat Imrsd AMD	N/mm	+/- 0.96	Can't Separate	Can't Separate
Adh Cpt/Mat Cyc MD	N/mm	+/- 0.96	Can't Separate	Can't Separate
Adh Cpt/Mat Cyc AMD	N/mm	+/- 0.96	Can't Separate	Can't Separate
Cld Resist H/A FF MD	Rate	Satisfactory?	Satisfactory	Satisfactory
Cld Resist H/A FF AMD	Rate	Satisfactory?	Satisfactory	Satisfactory
Cld Resist Orig FF MD	Rate	Satisfactory?	Satisfactory	Satisfactory
Cld Resist Orig FF AMD	Rate	Satisfactory?	Satisfactory	Satisfactory
Abr H18 1000g 2000c	Cycles	2000	2000.00	2000 00
Fiber Loss H18 1000g 300c	Grams	0.2	0.07	0.18
Heat Aging @ 90°C	Rate	4 MIN	5.00	5.00
Flam MD	mm/min	100 MAX	47.80	41.70
Flam AMD	mm/min	100 MAX	36.60	25.40
Breaking Strength MD	Newton	330	904.20	895.40
Breaking Strength AMD	Newton	330	741.88	765 00
Tongue Tear MD	Newton	53.4	72.32	71.98
Tongue Tear AMD	Newton	53.4	89.88	96.32
Resist Beard/Fuzz H18	gm	0.2	0.02	0.03

Abr H18 1000g Failure	Cycles	RESULTS	3900.00	9525.00
Nib Wear MD	Rate	Satisfactory?	Satisfactory	Satisfactory
Nib Wear AMD	Rate	Satisfactory?	Satisfactory	Satisfactory

[0029] The throw-in mats of the present invention offer many advantages over throw in mats 10 of the prior art. For example, the thermoplastic backing material 20 of the throw-in mats 10 is recyclable. This limits manufacturing costs in terms of waste

removal and can help to minimize raw material costs. Second, the throw-in mats 10 have the look and feel of rubber at a cost savings in terms of manufacture and raw material costs over rubber. Third, the thermoplastic backing material does not require a latex backing layer in order to adhere the backing material to the primary backing layer. Fourth, the throw-in mats 10 are relatively easy and cost-effective to manufacture.

[0030] While the invention has been described in terms of preferred embodiments, it will be understood, of course, that the invention is not limited thereto since modifications may be made by those skilled in the art, particularly in light of the foregoing teachings.